STATEMENT OF WORK

FEDERAL AVIATION ADMINISTRATION
MIKE MONRONEY AERONAUTICAL CENTER
AEROMSPACE MEDICAL RESEARCH (AAM)

HIGH PERFORMANCE COMPUTING CLUSTER
ATTACHMENT 1

June 12, 2012

STATEMENT OF WORK
HIGH PERFORMANCE COMPUTING CLUSTER

C.1 INTRODUCTION

The Civil Aerospace Medical Institute (CAMI) located at the Federal Aviation Administration (FAA) Mike Monroney Aeronautical Center (MMAC) in Oklahoma City, Oklahoma, is the medical certification, education, research, and occupational medicine wing of the Office of Aerospace Medicine (AAM) under the auspices of the Office of Aviation Safety (AVS). The CAMI mission is to improve safety, security, health, and survivability of aviators, cabin crew, and the flying public. CAMI Aerospace Medical Research Division (AAM-600) personnel work in two (2) major scientific research laboratories, using complex engineering and test facilities and medical research systems designed to evaluate enhancements to the interface of the human operator with the technological components of the National Airspace System (NAS). Thus, AAM-600 assets are applied to improve the security, safety, health, and performance of the principal components of the NAS: the human operator and the flying public that s/he serves.

Bioaeronautical Sciences (AAM-610) laboratory personnel perform research activities regarding pilot certification and performance, aircrew health, atmospheric and radiation risk analysis, and biological factors important to aerospace safety. *Protection & Survival (AAM-630)* laboratory personnel provide state-of-the-art information and evaluations of procedures and equipment pertinent to aircraft accident investigations, aircraft accident survivability, and passenger / crewmember health and security during normal operations and emergency events, such as in-flight fires, decompression, emergency aircraft evacuations, and crash landings on land and water. Research groups perform protection and survival research: cabin safety, biodynamics, environmental physiology, medical, and vision. Specialized research facilities comprising the AAM-630 laboratories include a hypobaric test chamber, protective breathing equipment and water survival test facilities, a dynamic impact test facility, and aircraft cabin research facilities.

C.1.2 BACKGROUND

The Radiobiology and Bioinformatics Research Teams of the FAA Civil Aerospace Medical Institute (CAMI) Bioaeronautical Sciences research lab (AAM-610) require access to a High Performance Computing System (HPCS). Ongoing Radiobiology research is currently using HPCS facilities and immediate access to such equipment would both reduce time needed for research and improve the quality of the research. The AMEN funding approved by Congress has been divided into a certain allotment for FY 2012 followed by another in FY 2013, the procurement shall thus be in phases, up to the physical limits of the site, as funds allow.

Current and planned Radiobiology and Bioinformatics research requires access to an HPCS. Current Radiobiology research is dependant upon part time external HPCS facilities which have diminished in availability by 50% over time and onsite immediate access to such equipment would both reduce time needed for research and improve the quality of the research. Future Radiobiology research projects will require fulltime use of HPCS resources such as those being sought by this procurement process and are awaiting the availability of such capability. Current Bioinformatics research is limited to workstations with insufficient RAM and storage, which has limited the longitudinal analysis of aircraft accidents and Aeromedical decision making. Future Bioinformatics research projects will explore in-memory databases, data warehousing, and analytic techniques, including spatial analysis studies benefiting aviation safety and the travelling public. Without HPCS these studies are not feasible.

C.1.3 PURPOSE

This Statement of Work (SOW) outlines the CAMI's (AAM-610) requirement for a High Performance Computing System (HPCS). The contractor must provide a HPCS solution with required recommended listing for Government performed room modifications to support the equipment.

C.1.4 SCOPE

The Contractor must provide a fully installed solution for the Government (AAM-600) requirement for High Performance Computer (HPC). This project is to be performed in two phases: : a) FY12 Phase I - includes Government Performed room modifications, and acquisition of sufficient initial computational resources to permit current and initially planned research projects; and, b) FY13 Phase II - purchase of additional computational resources to allow larger planned future research projects. Note: All room modifications accomplished by the government in Phase I shall be performed to accommodate the purchase of additional computer resources during Phase II.

Unless specified otherwise, "standard industry practice" must be used to meet requirements of the SOW.

The contractor must perform this contract in accordance with the SOW and all Government approved plans developed in response to this SOW.

C.1.4.1 DEFINITIONS, ACROMYMS & TERMS

Definitions, Acronyms and terms used in this document are herein described.

(a) Accessories - a mechanism or device employed to facilitate or increase the effective use of the HPCS.

(b) Contract Data Requirements List (CDRL) Format –

- Except where explicitly specified otherwise, CDRL items identified in this SOW must be delivered to the Government on Compact Disk (CD) compatible with PC-based Microsoft Windows 2003® and Windows XP® operating systems. Where feasible, the contractor may use electronic transfer for deliverables in lieu of CDs. Except where explicitly specified otherwise, CDRL items must be provided in text-searchable Adobe Portable Document Format® (PDF). Unless specified otherwise, "days" refer to calendar days.

- All data deliverables must be accompanied by a Letter of Transmittal (LOT), E-mail message (5 megabyte limit), or File Transfer Protocol (FTP) site referencing the appropriate CDRL number. For data deliveries identified as Letter of Transmittal (LOT), only the letter or message of transmittal must be provided to the addressee.

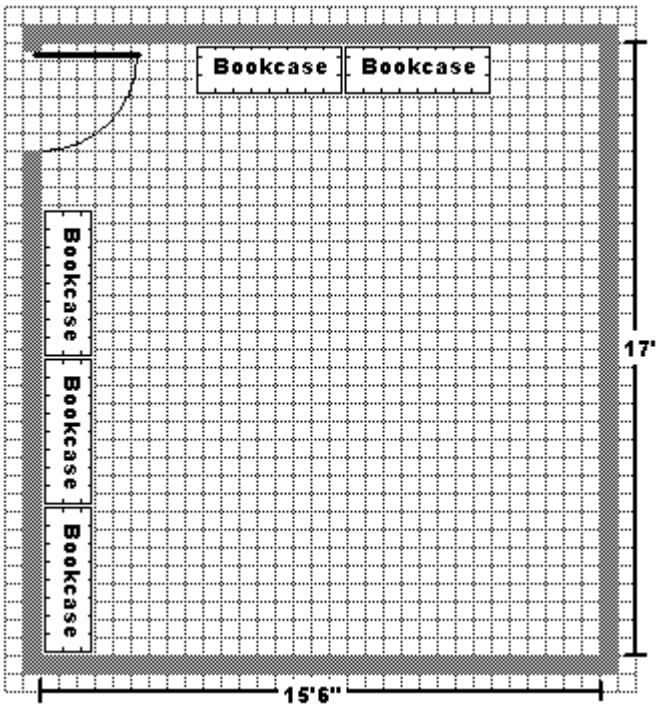
(c) Consumables – parts such as cooling fans, batteries, etc., which one would reasonably expect could need replacements within the expected 4 year lifespan of the HPCS.

(d) Contracting Officer - All references to the Contracting Officer (CO) will be defined as the Government Contracting Officer

(e) Contracting Officer's Representative (COR) - the Contracting Officer may designate other Government personnel to act as his or her authorized representative for contract administration functions which do not involve changes to the scope, price, schedule, or terms and conditions of the contract. The designation will be in writing, signed by the Contracting Officer, and will set forth the authorities and limitations of the representative(s) under the contract. Such designation will not contain authority to sign contractual documents, order contract changes, modify contract terms, or create any commitment or liability on the part of the Government different from that set forth in the contract.

(f) Component – a part or assembly of parts that serves a specific function within a larger system.
(g) EM (expansion module) - A separate identifiable set of components which can be added to the SHPCS (see subparagraph 'r' immediately below) to increase its capabilities. Examples would include such things as compute nodes, disk drive arrays, etc., that can be incrementally added to the SHPCS as part of its transformation from the base HPCS system to the more capable FHPCS (see subparagraph 'h' immediately below). This includes all components needed to make the EM a functional part of the HPCS system.
(h) FHPCS – Final High Performance Computing System, i.e., the maximum allowable build out of HPCS in required site, with emphasis on additional CPU based compute nodes.
(i) Overhaul - The disassembly, cleaning, inspection, repair, rework, replacement of parts or components, reassemble and test of any item or accessory in accordance with applicable technical manuals, directives, or authorized manufacturer's publications to provide an operationally safe, serviceable, and reliable item.
(j) Physical demands – demands for physical resources such as space, power, cooling, etc.
    1. Power required in watts or kW, with voltage, current.
    2. Heat load generated in Btu.
    3. Method of cooling (internal or external; chilled water, air, oil, etc.).
    4. Dimensions
    5. Mass (or weight) and resulting floor loading from installation in lbs/sq.ft.
(k) Manuals - Commercial manuals used for operational and maintenance actions, training, and optional engineering and contractor maintenance support after installation of the High Performance Computer (HPC)
(l) Repair - the restoration or replacement of parts, components, or material as necessitated by wear and tear, damage, or failure of parts, or the like, in order to maintain the specific item or material in efficient operating condition.
(m) Repairable - an unserviceable item that can be repaired and restored to a serviceable condition.
(n) Replace - the replacement of items that are determined to be beyond economical repair
(o) Scheduled Maintenance - that maintenance which is deemed necessary to be accomplished at prescribed intervals.
(p) Schematic – A detailed written description of an assembly of components. At the minimum, it shall include:
    1. A diagram or diagrams, showing all components and their relative placements
    2. A list of all components
    3. A summary description of the assembly of components, including:
        i. its physical demands when operating at full capacity, normal load, and minimum load
        ii. a list of any additional components that are not part of the assembly but required for its successful installation, along with instructions for their use in installation of the assembly .
(q) Serviceable - capable of meeting the requirement and performing the function for which designed or modified, and meets all test requirements established by the work specification.
(r) SHPCS – Starting High Performance Computing System, i.e., the starting configuration of the HPCS hardware. It is the base HPCS system that meets the minimum technical and physical requirements.
(s) Site (CAMI Room 353C) – The room is a 17 ft by 15.5 ft with 10 ft false ceiling and Approximately 4 ft of space above the ceiling. The room is located on the 3rd floor. The room has 1 normal width door. Building ventilation is closed loop. It currently has one 20A-110VAC Circuit, 1 telephone jack, 1 ethernet port, and AC suitable for use as a storeroom or lightly used office space. For planning purposes floor loading limits should be considered to be of standard office type environment (50 lbs per sq.ft) and has yet to be further defined.

The room currently has 5 bookcases (4 ft. x 7 ft. x 16”), 3 of which may be removed from the room if needed to provide additional space for the HPCS. The 2 bookcases that must remain may be placed anywhere in the room, at the vendor’s discretion.



C.1.4.2 ACRONYMS:

CAMI: Civil Aerospace Medical Institute
CO: Contracting Officer
COR: Contract Officer Representative
CDRL: Contractor Data Report Listing
EM: Expandable Module
FHPCS: Final High Performance Computing System
FAA: Federal Aviation Administration
HPC:High Performance Computer
HPCS: High Performance Computing System
LANL: Los Alamos National laboratory
MCNPX: Monte Carlo N-Particle Extended, radiation transport software from LANL
MPI: message passing interface
PMR: Project Management Review
SHPCS: Starting High Performance Computing System
SOW: Statement of Work

C.1.5. PHASES

The result of this procurement is expected to provide AAM-610 with HPCS including, but not limited to:

(a) Computer hardware and software components, including software upgrades, as appropriate
(b) Integration and installation services
(c) Expanded Modules in Contractor Proposed Format
(d) Hardware Maintenance Support

(e Software Licenses' (where appropriate)
(f) Training of key personnel at CAMI
(g) Technical and User Manuals

However, it must be stressed that this project will be accomplished in two separate phases, each of which will be tasked and funded separately. Phase I is to be accomplished during the FY-2012 following Government performed facility/room modifications and Phase II is to be accomplished during FY-2013. This SOW is meant to address both Phase I and Phase II but each phase must provide fully functioning HPC capabilities

C.1.6. CONTRACTOR/SUPPLIER QUALIFICATIONS

(a) The Contractor must a have minimum of 3 years experience supplying and supporting HPC hardware. The Contractor must have demonstrated ability and familiarity with HPC systems.

C.2 DELIVERABLES

The Contractor must provide a HPC solution and a list of modifications required to allow the HPC to operate at the site in accordance with SOW (Phase I and Phase II) on or before 30 days from completion of Government performed room modifications. Other deliverables include:

(a) Narrative with Supporting Information with proposal to include but not limited to:
1. The Contractor should include processor information, how many total by Phase what kind, Specifications (and if not Intel, published performance benchmark information).
2. RAM: Average per core, maximum per core, minimum per core, cost to upgrade per node.
3. Detail how the Nodes are interconnected
4. Detail how much useful drive space is available
5. Projected Physical Needs: SHPCS, full FHPCS, power needed, voltage, current, Wattage, cooling needed: BTU's per hour, where will it be dumped (e.g. room air, chilled water line, floor strength needed; mass, footprint, pound per sq ft.
6. Proposed physical layout of: SHPCS, full FHPCS with a configuration schematic indicating the physical, electrical and environmental configurations for both Phases I and II.

(b) SHPCS (Phase I)
(c) Schematics for SHPCS with summary description (Phase I with proposal)
(d) Manual for maintenance and operation of SHPCS (CDRL 0001/with delivery of hardware)
(e) Itemized price list of proposed EMs. Proposed EMs shall include at least
1. CPU computing node EM
2. CPU + GPGPU computing node EM
3. Hi-memory CPU computing node EM
4. 1, 2, 5, and 10 TB HD space expansion EMs
5. Communications EM
6. Non-volatile memory EM

(f) (g) A Schematic for each proposed EM with summary description (Phase I/II)
(h) A manual for proper maintenance and installation of each type of EM (CDRL 0001/with delivery of EM)
(i) Manual describing how to incrementally convert the SHPCS to the FHPCS, one EM at a time (CDRL 0001/with the delivery of hardware)
(j) Manuals for all installed software
(h) Any provisional spares purchased and provided to support Phase I operations and Phase II sparing recommendations.

(i) Manuals and price lists as appropriate for recommended provisional spares
(j) Any miscellaneous parts not included in the above but required for the operation of the above hardware and software
(k) Price list for hardware
(l) Instructions for proper use of such hardware
(m) Written copies of any warranties and maintenance agreements (CDRL 0002)
(o) Training on system use

NOTE: The Contractor must coordinate all Deliveries and Installation with the Government.

C.3 REQUIREMENTS

C.3.1 MINIMUM REQUIREMENTS FOR SHPCS

The Contractor must provide to the minimum requirements for SHPCS as follows:

(a) The OS will be MS Windows 2008 HPC version, provided by the vendor
(b) At least 2.66 GB ram per core
(c) At least 20TB of useful HD space (or other, faster, non-volatile memory). The devices could be incorporated into the compute nodes, as separate array, or a combination.
(d) Compute node CPU computing power equivalent to 352 Intel® Xeon X5650 (2.66Ghz) "Westmere" Processors (Six-Core) interconnected connected with 40 Gbs infiniband. The processing power evaluation formula is outlined as follows:

CPU Score = 1000 x *M* x (*# of cores*) x (*clock speed in GHz*) x (*QPI*) / (N)
where N is a normalizing factor such that the basis SHPCS system score is 1000

M is a multiplier based on expected software compatibility, C_{base} (=352) is the minimum # of Intel 5650 2.66 GHz cores given above, and N is a normalization factor

$N=C_{base}$ x 2.66 x 6.4

CPU Processors other than Intel must be demonstrated as fully compatible with all software in the software list (Sec. 4). For a proposed solution using processors with no QPI rating (e.g., AMD), a values for QPI and M will be assigned using published benchmarking data from the CPU manufacturer and Intel, giving equal weight to each in the event of discrepant numbers. The SHPCS vendor should supply the available data needed to compare the power of the proposed processors with the standard design noted above.

While considered an essential optional EM, for evaluation of the SHPCS CPU+GPGPU compute nodes will be evaluated as if only the CPU were present (i.e. the GPGPU were Non-functional).

Sample compute node:

2 Intel® Xeon X5650 / 2.66 GHz (6-core) Processors (total of 12 CPU cores)
8 4Gb ECC REG DDR3-1333 HPC Memory Modules (2.66 Gb Ram / CPU core)
Integrated Dual-port Gigabit Ethernet Controller Network Card
Integrated Mellanox ConnectX QDR Infiniband 40Gbps Controller
Integrated IPMI 2.0 Management Card

(e) At least 1 head node equivalent or superior in all aspects of performance to the sample

Sample head node:

2 Intel® Xeon X5650 (2.66Ghz) "Westmere" Processors (Six-Core) 12 processor cores
8 4GB ECC REG DDR3-1333 (HPC Memory Module)
7 2TB Enterprise SATA Hard Drives (10TB Net Storage RAID-6)
1 Optical Drive DVD-ROM Drive
1 SAS/SATA PCI Express RAID Controller
1 Integrated Dual-port Gigabit Ethernet Controller
1 Mellanox QDR (40Gbs) InfiniBand Network adapter - PCI Express 2.0 x8
1 Management Integrated IPMI 2.0 KVM-Over-LAN Management Card

(f) At least 1 hi-memory node equivalent or superior in all aspects of performance to the Sample.

Sample hi-memory node:

2 Intel® Xeon X5650 (2.66Ghz) "Westmere" Processors (Four-Core), 8 processor cores
8 16 GB ECC REG DDR3-1333 (HPC Memory Module) RAM Modules (128 GB total)
1 SAS/SATA PCI Express RAID Controller
1 Integrated Dual-port Gigabit Ethernet Controller
1 Mellanox QDR (40Gb.s) InfiniBand Network adapter - PCI Express 2.0 x8
1 Management Integrated IPMI 2.0 KVM-Over-LAN Management Card

(g) Other components, such as power supplies, cables, etc, need to support end ensure the operation of the SHPCS compute and head nodes.
(h) MPI Software needed to make the SHPCS useable as a single cluster by Los Alamos National Laboratory software package MCNP/MCNPX.
(i) Software and/or hardware needed to pool memory from multiple compute nodes to place and manipulate databases in RAM.

C.3.2 REQUIREMENTS FOR PROPOSED FHPCS

The Contractor must provide to the requirements for FHPCS as follows:

(a) Performance score should be more than 2.5x the performance score of the SHPCS
(b) The FHPCS should maximize computing power inside the utilizable space in the room while meeting legal requirements for working space in accordance with ADA and OSHA Safety guidelines for access, noise, etc.
(c) System schematics, total cost, and expected physical demands:
    1. Average Floor Load: the weight of each computer cabinet divided by the floor area under that cabinet plus the area from the cabinet to an adjacent wall plus half of the clear space around the cabinet to the next cabinet.
    2. Maximum Allowable Average Floor Loading: limited to 50 psf in the south half of the room and 100 psf in the north half of the room.

C.3.3 GENERAL REQUIREMENTS OF ALL HPCS CONFIGURATIONS:

The Contractor must provide all HPCS requirements as follows:

(a) Computational Process Control and Infrastructure

1. A requirement for the HPCS hardware is the ability to accommodate a large (95% utilization of available CPU cores) parallel Monte Carlo simulation computation task under Windows HPC. This task requires the use of many simultaneous cores, each with a modest RAM requirement of ~1 GB of RAM per core, and the ability to store the calculations on a hard disk or SSD. The HPCS hardware should accommodate massively parallel Monte Carlo simulations (MCNP/MCNPX) on all but a few cores at almost all times through MPI/MPICH standards.
2. A requirement for the HPCS hardware to accommodate an analysis of longitudinal aviation safety and medical epidemiological data running under Windows, utilizing a modest amount of cores (5% or less per job), but might require several hundred GB of RAM, and sufficient storage space to hold databases and results of longitudinal data analyses.
3. Ability to load balance, control concurrent jobs, and change the allocation of the HPCS resources as needed without replacing components in order to provide flexible hardware sharing/ partitioning optimized for the current submitted jobs, and possible future users.
4. A requirement for the system to shutdown without damage to components in the event of a failure of power to the cooling source of the HPCS hardware. This would presumably occur when either an environmental or component temperature threshold was passed or when the system began to operate on emergency power (future cooling is compromised). The purpose is to protect the hardware in the event of unexpected inadequate cooling of components for various reasons (e.g., the failure of room AC or a chilled water supply failure, for any reason). It would not require the graceful shutdown of the running applications, only head nodes, drives and other components that might suffer damage from an ungraceful shutdown.
5. A requirement for the system to shutdown without damage to components in the event of a failure of standard power to the HPCS hardware. Shutdown capability might have to occur more quickly than the thermal warning shutdown, since cooling and primary power would both be lost in the environment of the HPCS hardware. It would not require the graceful shutdown of the running applications, only head nodes, drives and other components that might suffer damage from an ungraceful shutdown. (Important to note that Air Conditioning to the building is turned on at 08:00 AM CT and off at 4:00 CT each week day and in turned off on weekends)
6. A requirement for option to purchase provisional spares to expand system capabilities if additional funds become available.
7. Vendor supported user validation of hardware and software setup before delivery.
8. System must fit in the available space. The HPCS room is a 17’ x 15.5’ room originally intended for long term storage of supplies, records, books, and other experiment related materials, which limits the size of the HPCS hardware. The Room is CAMI 353 C Dimensions: 17’ x 15.5’ x 10’ (false ceiling), a room on the 3rd floor of the CAMI building. Floor strength (max static and dynamic loads, etc): Unknown, originally built as lab space in 1960’s. Vendors should be aware that government costs for room modifications will reduce the total available budget to purchase the FHPCS.
   Current room status is:
   (i) Power: Current is 1 20 amp, 120V circuit, with 4 outlets; Expected needs are up to 60 kW (modern computing hardware densities can reach 15 kW or more per rack [9 kW max was standard for older hardware] x 4 racks = 60 kW) for computer hardware, and additionally, whatever is needed to keep that hardware cool.
   (ii) Communications (inactive now): 1 network port to MMAC network, 1 phone jack, (a connection to the Toxlab local net is expected).

(iii) Cooling: The room has one AC vent in the ceiling and no current access to outside air. Possibilities exist for direct water cooling though plumbing to the roof or closed loop AC with an external heat dump.

(iv) Other Items: The site currently has 5 bookcases, 3 of which may be removed from the room if needed to provide additional space for the HPCS. The 2 bookcases that must remain may be placed anywhere in the room, at the vendors discretion.

9. The HPCS is expected to operate at near full load (95% of CPUs in use) most (90%) of the time.
10. In the event of a primary (i.e. building) power and/or cooling failure (e.g. due to a thunderstorm), the HPCS must be able to shut itself down without damage to its components using built in UPS. While data on compute nodes can be lost, the hardware components must survive the shutdown when main building power is lost. 11. The HPCS must meet current noise and safety requirements. The room will be generally unoccupied and the HPCS usually accessed remotely, except for maintenance requirements. However, rooms around the target room are continually occupied office spaces and noise levels in these areas must meet requirements.
12. The HPCS must only require a small, part-time staff to operate and maintain (0-1 persons). Internet access will be limited to as needed for maintenance and software installation. The system will be operating at all hours (24/7) performing computational jobs when CAMI personnel are not present.
13. The full warranty on parts and labor must be at least 3 years.
14. The system must be deliverable to the site on the 3rd floor without physically modifying the building, beyond expansion of doorways, to limit excessive building modification costs. Building access is via loading dock or normal door. The south loading dock provides space to unload and immediate access to a freight elevator (86 inches tall, 92 inches wide and 10 feet deep, with a 4,000 pound capacity). The hallways on the 3rd floor are 6 ft wide. There is one double door between the site and the freight elevator.
15. The installed HPCS in all phases must meet current ADA and other applicable safety guidelines regarding spacing and access with respect to item placement, electrical, noise, etc.
16. Thus a complete floor plan with proposed layout of SHPCS and FHPCS, with appropriate information for evaluation by safety inspectors must be provided.

The Contractor must provide to the **minimum requirements** for HPCS Configurations as follows:

(b) Alleviation of physical risks to the HPCS components

In the event of loss of primary (i.e. building) power the HPCS must be able to shut itself down without damage to its components. Also a failure of the building cooling capability or of the cooling capability of the HPSC itself, the HPCS must be able to shut itself down without damage to its components. Thus,

1. A requirement for the HPCS to shutdown without damage to components in the event of a building power failure resulting in failure of standard power to the HPCS hardware. Shutdown capability might have to occur more quickly than a thermal warning shutdown (as in item b) below), since cooling and primary power would both be lost in the environment of the HPCS hardware. It would <u>not</u> require the preservation of data in RAM or the controlled shutdown of the running applications; however it is a requirement that all hardware, such as head nodes, drives and other network components that might suffer damage from an over temperature, or uncontrolled shutdown be protected by the

systems inherent ability to sense such a set of conditions and effect an appropriate shutdown.

2. A requirement for the HPCS to monitor ambient and equipment internal temperatures and shutdown without damage to components in the event of a failure of power to the cooling source of the HPCS hardware. This would presumably occur when either an environmental or component temperature threshold was passed or when the system began to operate on emergency power (future cooling is compromised). The purpose is to protect the hardware in the event of unexpected inadequate cooling of components for various reasons (e.g., the failure of room AC or a chilled water supply failure, for any reason). It would not require the preservation of data in RAM or the controlled shutdown of the running applications; however it is a requirement that all hardware, such as head nodes, drives and other network components that might suffer damage from an over-temperature, or uncontrolled shutdown be protected by the systems inherent ability to sense such a set of conditions and effect an appropriate shutdown.
3. A requirement for the HPCS to shutdown without damage to components in the event of activation of the room fire suppression system, unless the fire suppression system activation is the result of a fire in the HPCS.

C.4 GOVERNMENT RESPONSIBILITIES

The Government will perform all required room modifications as outlined in the Contractors proposed solution for Phase I & Phase II prior to Installation of Phase I equipment.

C.5 CONTRACTOR RESPONSIBILTIES

The Contract must meet or exceed all the requirements outlined above and by mutual agreement a Post Award Conference to be held at the Governments facility within thirty (30) days after contract award. The Contractor must notify the Government of the conference date at least fourteen (14) days prior to the conference. At this conference, the contractor should address the plans, coordination of schedules for the HPC effort and any clarifications of administrative/business requirements must also be discussed.

C.5.1 PROJECT MANAGEMENT REVIEW (PMR)

(a) The Contractor must conduct a monthly telecom. The PMR must include, but not be limited to, current schedule, identification of problem areas, accomplishments since the last PMR, program risks and risk mitigation plans, manufacturing status, and test status.

C.6 LOGISITICS SUPPORT

The Contractor should assist the Government in achieving maximum operational benefits from the HPCS and should it consist but is not limited to the following:

(a) Technical Support
(b) Common and Emergency Spares Parts List
(c) Spares Provisioning (i.e. batteries, blades, etc)
(d) Support Equipment Listing
(e) Technical Publications, Operational and Maintenance

C.6.1 TECHNICAL SUPPORT

a) The contractor must prepare and submit to the Government a list of the spare parts and assemblies recommended for the support of HPC System maintenance.

CDRL 0003 list of the spare parts and assemblies recommended for the support of HPCS operations and maintenance

C.6.2 COMMON AND EMERGENCY SPARES

The parts list must contain a list of all replaceable parts and assemblies used in the HPCS, in a top-down breakdown order. The list must contain all the information necessary to identify and order replaceable parts.

C.6.4 SUPPORT EQUIPMENT

The contractor must prepare and submit to the Government a list of recommended support equipment for the support of HPCS operations and maintenance.

Support equipment is divided into the following categories:

a. Commercially available tools and test equipment
b. Special tools and test equipment

CDRL 0004 list of Recommended Support Equipment for the support of HPCS operations and maintenance

C.7 QUALITY CONTROL PROGRAM

The Contractor is responsible for monitoring and delivering this requirement in accordance with the prevailing commercial or prevailing ISO-ICS 35 standards.

C.7.1 QUALITY CONTROL

The Contractor is responsible for ensuring the quality of all deliverables and services in accordance with prevailing ISO standards as provided by contractor personnel.

C.8.1 LOCATION OF WORK

All requirements under this contract related to the installation, integration, and post-installation testing of HPCS acquired under this contract shall be delivered at the following location, unless directed in writing by the CO:

Mike Monroney Aeronautical Center (MMAC)
Civil Aerospace Medical Institute (CAMI)
6500 South MacArthur Blvd.
Oklahoma City, Oklahoma, 73169

C.8.2 NORMAL HOURS OF OPERATION

Normal hours of operations will generally occur between the hours of 6:00 a.m. and 6:00 p.m., Monday through Friday, excluding those days recognized as Federal holidays. Contract personnel shall need authorization from the CO to gain access to MMAC buildings outside these hours. This requirement applies to the hours between 6:00 p.m. and 6:00 a.m. each day, all hours on weekends

or holidays, and anytime MMAC is otherwise closed. Generally, no activity is anticipated under this contract other than during normal hours of operation. Should such activity is required by the Government, the contractor will be advised by the CO, and will be provided as much advance notice of the requirement as practicable. Should the contractor wish to perform certain activities outside normal hours of operation, they must provide the CO with as much advance notice as practicable, to allow time for arranging after-hours access. In no case, however, will activities outside normal hours of operation be permitted without prior authorization from the CO.

APPENDICES:

Note: A1 identifies software that must be able to run on the system. A2 Identifies Government needs to develop power and cooling room revision cost estimates that will be used to evaluate the proposals.

A1 .Software list

- Microsoft Windows HPC*
- Job Control Software*
- Microsoft SQL
- 64-bit Statistical Analysis Software (SAS)
- Tibco SPlus
- Tibco IMiner
- Open Source software, e.g., R
- HPC Microsoft Studio Compilers
- 64-bit versions of Fortran
- 64-bit version of C
- 64-bit version of C++
- MCNPX

*Provided by the vendor

A2. Sample Air Cooled FHPCS (After FY 13 additions)

Total of 61 Compute Nodes (mixed types) & 15616Gb Ram + 41Tb Net Storage (RAID-6)
Total of 976 CPU Compute Cores using Intel Xeon E 2670 CPUs
Nodes include HPC Class Ram Memory and Enterprise Raid Edition Hard Drives
QDR 40Gb/s Infiniband interconnect
IPMI Remote Management for All Nodes
Free remote Testing of customer code on Cluster prior to final order / shipment
Windows HPC Server OS Installation, Job Scheduling, Management Software & Configuration
Includes Customer Application Software Installation
Includes self-contained water cooled enclosures dumping heat to room AC,
Power Distribution & Cable Management
Includes UPS Backup Power for Entire Cluster / Rack for UPS
TOTAL POWER REQUIRED in watts = 64000
BTU's/HR = 70500, AIR

A3. Sample Water Cooled FHPCS (After FY 13 additions)

Total of 96 Compute Nodes (mixed types) & 4096Gb Ram + 20Tb Net Storage (RAID-6)
Total of 1152 CPU Compute Cores using Intel Xeon X5650 CPUs
Nodes include HPC Class Ram Memory and Enterprise Raid Edition Hard Drives
QDR 40Gb/s Infiniband interconnect

IPMI Remote Management for All Nodes
Free remote Testing of customer code on Cluster prior to final order / shipment
Windows HPC Server OS Installation, Job Scheduling, Management Software & Configuration
Includes Customer Application Software Installation
Includes Water Cooled Enclosures and Power Distribution & Cable Management
Includes UPS Backup Power for Entire Cluster / Rack for UPS
TOTAL POWER REQUIRED in watts = 40000
BTU's/HR = 137000, WATER